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Forestry Research West

A report for land managers on recent developments in forestry research at the four western Experiment Stations of the Forest Service, U.S. Department of Agriculture

Forestry Research West

In This Issue

Cover

Since 1971, enrollees of the Youth Conservation Corps have been performing conservation work on public lands. Here, workers are clearing flood debris from a Nebraska lake. A recent study sheds light on the various benefits youths receive from the program. Details begin on page 1.

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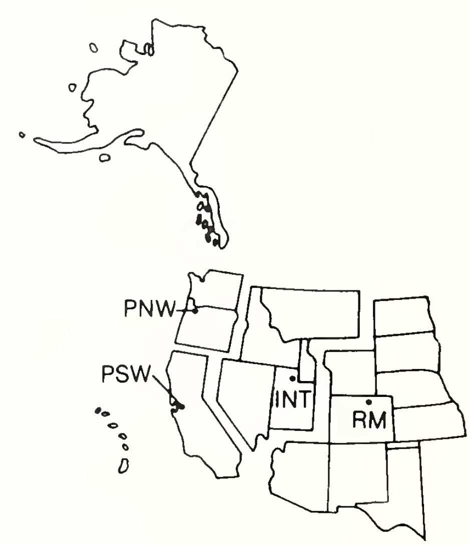


The YCC Program. . .do youths benefit?

by Rick Fletcher
Rocky Mountain Station

A YCC enrollee conducts cabin restoration work in Crawford, Nebraska.

For decades, American youths have been attending outdoor summer programs sponsored by various organizations such as YMCA, YWCA, Outward Bound, church groups, and government agencies. The Youth Conservation Corps (YCC) has been a program of particular interest to several federal and state natural resource agencies.

YCC, created as a pilot program in 1970 by the U.S. Congress, focuses on:

1) accomplishing needed conservation work on public lands;

2) providing gainful employment during the summer months for youths aged 15 to 18 years; and

3) increasing the environmental understanding of these youths about our nation's natural, historic, and cultural resources, and the principles of wise resource management.

The YCC program is administered by the USDA Forest Service, and several natural resource bureaus within the U.S. Department of the Interior.

Because of its tremendous success and popularity during its first two years of operation, funding was increased, YCC was made a "permanent" program, and federal matching funds were provided to operate projects by state and local units of government on nonfederal public lands. Enrollment and federal funding peaked in the late 1970's.

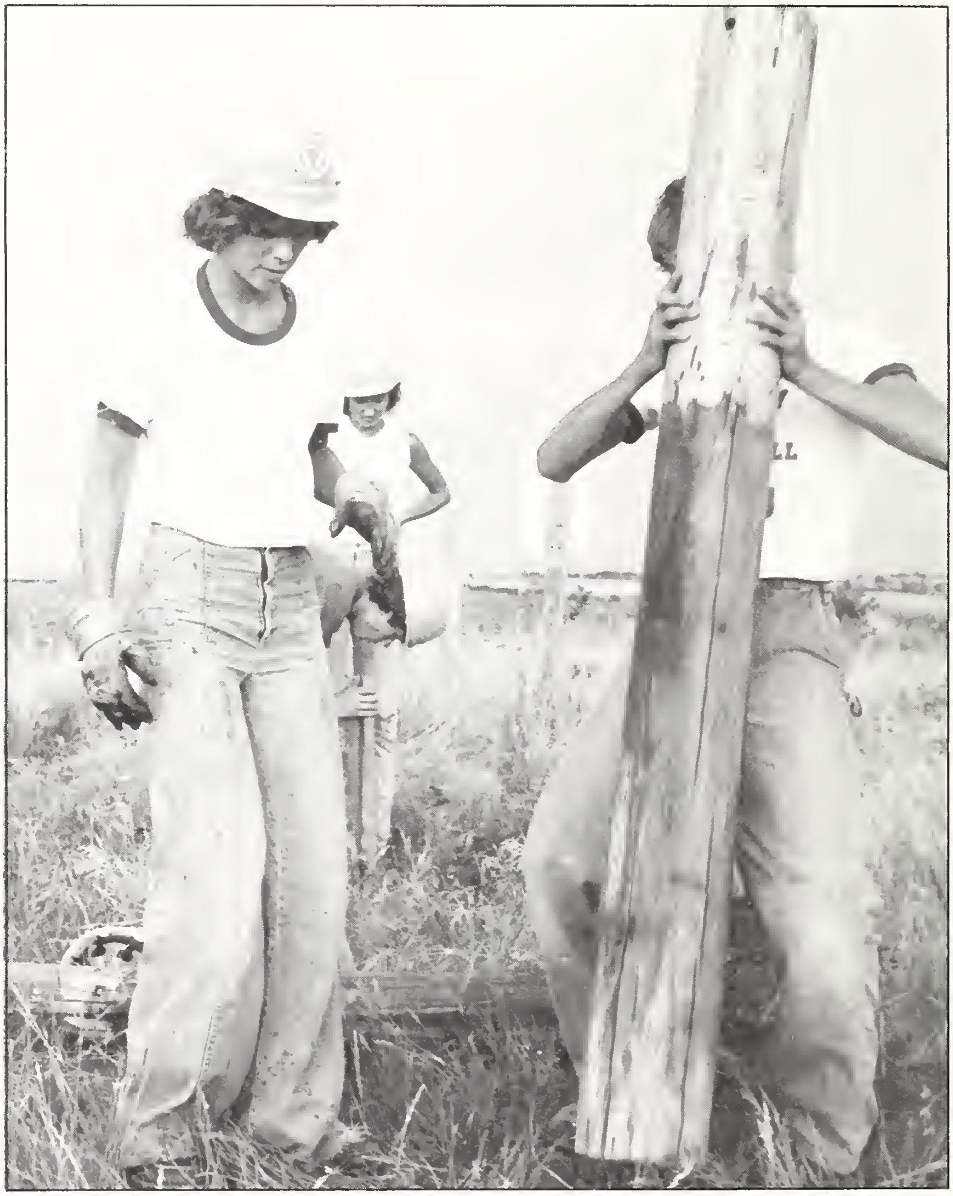
Calendar Year	Number of Enrollees	Millions of Federal $'s
1971	2,676	2.5
1972	3,495	3.5
1973	3,510	3.5
1974	9,813	10.0
1975	13,984	13.2
1976	23,114	32.0
1977	37,381	60.0
1978	46,000	60.0
1979	39,495	60.0
1980	33,900	54.8
1981	17,368	26.0
1982	2,171	3.6
1983	6,438	10.0

From 1971 through 1981, participants were paid the minimum wage to spend 30 hours per week performing conservation work on public lands, and they contributed 10 hours per week for environmental education activities. (Most summer camps run for six or eight weeks.) During the early years of the program, camps were either residential (participants lived at camp five or seven days per week) or nonresidential (participants commuted daily from home). Today, most camps are nonresidential, and the youths are paid for 40 hours of work per week, about two of which are devoted to environmental education.

Early evaluations of the program's success

The 1970 enabling legislation required systematic evaluations to determine the effectiveness of the program during its pilot years. The summer 1971, 1972, and 1973, programs were evaluated by the Survey Research Center of the University of Michigan's Institute for Social Research (ISR). Dr. B.L. Driver, who worked as a member of this research effort and is now a researcher with the Rocky Mountain Station in Fort Collins, Colorado, says, "Those studies focused on the overall success of the program, how satisfied different types of enrollees were, which types achieved the greater gains in environmental awareness, and which types of camps and program operations were most effective."

The results of this research were credited with influencing the congressional decisions in 1972 and 1974 to expand the YCC and change its status from a pilot to a permanent program.



These workers are helping construct a hunter access parking lot in Nebraska.

Studies of possible long-term benefits

As YCC grew in size, program administrators became more interested in tracing the long-term benefits. For this reason, they decided, in 1978, to fund a 5-year program of research to evaluate possible long-term benefits of YCC participation. That research was conducted between 1978 and 1983 as a cooperative effort between the Rocky Mountain Station and Colorado State University, under Driver's supervision.

Before long-term benefits could be measured, it was necessary to first determine which types of benefits might possibly be related to YCC participation. This was accomplished by four separate studies:

1) A mail questionnaire survey was made of 581 YCC camp staff and 27 program administrators to obtain their perceptions of possible long-term benefits.

2) Other possible benefits were identified by a literature review of studies on the benefits of summer youth programs similar to YCC.

3) In addition, the literature in developmental psychology related to value and behavior changes in teenagers was reviewed to glean possible benefits related to social integration, career, orientation and similar processes.

Planting alternate strips of browntop millet and sunflower seeds on the Tuskeegee Ranger District, Alabama.

4) These three efforts produced a long list of possible beneficial changes in the YCC enrollees' knowledge, skills, attitudes, and behavior. The research team pared the list to about 50 possible benefits which most likely would be influenced by YCC participation. Questionnaires were developed to tap each of the remaining benefit themes and were included in a pilot study of 600 former enrollees and 600 parents of former enrollees in the 1974 to 1977 YCC programs. They were asked to rate the degree to which they perceived YCC participation had influenced that change. The results showed that many benefits were positively attributed to the YCC program. In addition, over 97 percent of the former enrollees and parents responded that they liked the program, and over 90 percent reported a positive general opinion of it.

The results of these studies were then used as a basis for a more systematic study. That study consisted of mailing follow-up questionnaires to 1,000 randomly selected enrollees and 1,000 parents of enrollees in the 1979 program, and to a control group of 800 unsuccessful applicants to the 1979 program, and 800 "unsuccessful" parents of such. The parents were asked to respond with reference to their son or daughter who had been an enrollee in, or unsuccessful applicant to, the summer 1979 program.

Mailings were made at 9 months and again at 26 months after the end of that program to measure perceived beneficial changes in the enrollees' and unsuccessful applicants' knowledge, skills, attitudes, and behaviors.

The mail questionnaires included scales to measure 36 different benefits. In a separate study, enrollees and parents were not informed that the research was being done to evaluate the YCC program. This was to test for any "halo" effects (exaggerated positive responses) which might be caused by the positive attitudes most enrollees and parents held toward the program.

What was found?

Responses to both questionnaires were good, with a 74 percent response rate for each. No halo effects were found, which increases confidence that the benefits reported were not exaggerated by the enrollees or parents.

The findings from the first questionnaire (9 months after the end of the 1979 program) showed that participants realized several of the 36 possible benefits. Most of them would be expected from the program. For example, the program placed youths from all socioeconomic and demographic backgrounds together to work and learn in a natural environment, with the objective of completing well-defined work goals through a group effort. Consequently, YCC participants learned more about conservation, environmental problems, and natural resource management than did the unsuccessful applicants in the control group. In addition, the enrollees scored higher on benefit scales related to learning to work more efficiently, getting involved with a group effort, and accepting and getting along with persons of other races. They also learned more about using handtools in a correct and safe manner, and developed more confidence in their ability to find and hold jobs.

Responses by parents of enrollees and unsuccessful applicants showed the same pattern of greater benefits for the enrollees. However, parents of those enrollees also reported additional benefits, such as increased natural resource ethnics, planning and/or organizing work, work efficiency, motivation, willingness to help at school, and personal honesty.

YCC assisted in a pheasant habitat project in Nebraska.

The findings from the second administration of the questionnaire (26 months after the program ended) showed basically the same pattern in perceived benefits as the 9-month questionnaire did. However, further evidence of benefits was found on a set of questions concerned with respondents' hobbies and daily activities. Parents of enrollees reported that their youths were participating in sports, athletics, or exercising; in activities involving nature appreciation; in outdoor recreation activities; and in organizations concerned with environmental issues, with a significantly greater frequency than reported by parents of nonenrollees.

Who benefitted how?

Respondents were categorized by their age, sex, ethnic background, family income, population of home community, and other characteristics. Then, tests were performed to discern differences between the enrollees and unsuccessful applicants within each of these categories. These analyses permitted conclusions to be drawn about what type of youth benefitted and in what ways.

The results are interesting. First, particular types of enrollees did benefit in different ways, compared to the same types of unsuccessful applicants. For example, female enrollees who came from cities with 50,000 or more population, reported considerably higher benefits related to interest in environmental problems, understanding of conservation, tool skills and safety, and willingness to help at school, than did their counterpart unsuccessful applicants.

Another example showed that white enrollees from the same size cities were more interested in school than unsuccessful white applicants.

Equally significant were the findings that the magnitude of difference between particular kinds of enrollees and unsuccessful applicants increased greatly over those found when comparisons were made overall for each of these two groups without differentiation by socioeconomic and other characteristics. For example, all of the differences in the overall mean scores were 0.6 or less (on a 7-point response format). However, many of the differences ranged from 0.7 to 1.1 when the subgroups of enrollees and unsuccessful applicants were compared.

Enrollees from residential camps were compared to those from non-residential camps to see if the benefits differed. They did; a statistically significant difference between these two types of enrollees was found on 12 of the 36 possible benefits. Most relate directly to what one would experience in a residential camp setting, such as pride in personal work, planning and organizing work, increased knowledge of tool skills and safety, motivation, healthy diet, and others.

Finally, analyses were made on the differences between different enrollee groups.

Results indicated that female enrollees showed higher interest in conservation than did male enrollees. Similar data showed that white enrollees showed higher tool skills and safety benefits than non-white enrollees, while non-whites showed slightly higher benefits for personal conservation action than did whites.

Value of the findings

The size, funding, and overall administration of the YCC program has changed since the 1979 evaluation. Therefore, these findings cannot necessarily be generalized to the current program. Nevertheless, they are useful for several reasons:

1) they document the type and magnitude of benefits created and nurtured by the YCC program for over 10 years;

2) this documentation will be a useful point of reference, as other federal and state youth conservation work programs are being considered. One example is the recent proposal in the U.S. Congress to create a large American Conservation Corps (ACC). The Congressional Record documents that reference has already been made to the YCC long-term benefits research in support of the ACC;

3) the results showed clearly that enrollees having different socioeconomic and demographic characteristics received different types of benefits. This information will be useful in developing similar programs;

4) results of the YCC research have also been used to enhance inferences about the likely benefits of other youth programs such as private youth camps.

The YCC program has created support and enthusiasm in enrollees, parents of enrollees, YCC camp staff, and program administrators; it has been one of the most positively accepted federal programs. It is unlikely that all of its benefits will ever be measured. Nonetheless, research has shown considerable lasting benefits of many kinds for its young participants.

(The 1984 YCC program will operate only on Federal lands administered by the U.S.D.A. Forest Service, National Park Service, and the U.S. Fish and Wildlife Service. Congress (P.L. 98–146) earmarked not less than $10 million of other appropriations within the three agencies' budgets for high-priority YCC projects. No line item YCC funds were appropriated. Minimum funding levels are almost equal for each of the three agencies).

Predicting wildland fire behavior

by Delpha Noble
Intermountain Station

Minute-by-minute fire behavior predictions may never be possible, but experience coupled with systematic calculations yields surprisingly good results.

The Forest Service has been a leader in the study of wildland fire since the agency was established over 75 years ago. In 1910, Chief Forester Henry Graves admonished the nation that "the first measure necessary for the successful practice of forestry is protection from forest fires."

It has been said that fire is among the oldest of words in any language, but its mathematical and physical study is among the most recent of modern sciences. The first systematic attempts to

describe wildfire behavior were conducted by Wallace Fons, a Forest Service researcher in California during World War II. Over the years, many other scientists continued the effort. When the Intermountain Station's Northern Forest Fire Laboratory at Missoula, Montana, opened in 1960, a concentrated long-term commitment to explain wildland fire behavior was begun.

Richard Rothermel, project leader of the Station's Fire Behavior research work unit, recalls:

"When we arrived at the Northern Forest Fire Laboratory in 1961, there was a sense of being overwhelmed, not only by all the unknowns of wildfire behavior, but also by how to use the new facility. There were at least two schools of thought in regard to the wind tunnels at the Laboratory: (1) bring in boxcar loads of fuel from all over the country for burning in the wind tunnels, and (2) weld the doors shut until we could develop a logical plan for the use of the facilities."

The researchers did not weld the doors nor did they ship in fuel by the boxcar load, but they did work hard at understanding fire spread and adapting concepts of modeling and systems to the problems of forest fire prediction. During the first 10 years a fire behavior model was produced. It took 10 more years to learn how to adapt it to field conditions and interpret the results for use by the "man on the ground."

Mathematical prediction models have progressed from nomograms to hand-held calculators for use on the fireline to sophisticated interactive computer programs. The end product sought by the Fire Behavior researchers has been a prediction method that could be used at all levels of the fire organization from the person on the fireline to managers involved with long-range planning.

A new dimension

Rothermel's mathematical model for predicting fire spread in wildland fuels is the cornerstone of today's fire behavior systems. The method, developed in the early 1970's, offered for the first time a system to evaluate rate of spread and fire intensity in surface fuels that account for over 90 percent of all fires.

The model was complete in the sense that no prior knowledge of a fuel's burning characteristics was required. All that was necessary were physical descriptions of the fuel and the environmental conditions in which it was expected to burn.

The introduction of Rothermel's model meant that systems analysis techniques could be applied to land management problems. As a result, a new dimension was offered to land managers for appraising consequences of proposed programs. Answers could be obtained for questions such as: What is the potential fire behavior after overstocked areas are thinned? Can logging practices be modified to reduce the potential fire hazard of the fuels they produce? How much slash should be left on the ground to produce the desired fire intensity for removing undesired reproduction? How long after cutting can a successful burn be achieved? With the new model, systems analysis could be applied not only to these broad aspects of forestry, but also to traditional activities such as presuppression planning and prescribed burning.

An early tool

When the Intermountain Station published Frank Albini's book of nomographs in 1976, the comment was made, "Frank let the genie out of the bottle." Albini, a mechanical engineer in the Fire Behavior unit, used Rothermel's fire model equations as the basis for nomograms or graphs that anyone can use to predict fire behavior. Constructed and organized for use in the office or in the field, the nomograms describe the behavior of the leading edge of a surface fire. Using these interconnecting graphs, fire managers can estimate forward rate of spread, intensity, flame length, and crown scorch height.

Answers from a black box

In 1979, when the researchers developed a program for a TI–59 hand-held calculator, the black box with an interchangeable module joined the Pulaski as a traditional tool on the fireline. Two thousand five hundred modules preprogramed to compute fire behavior were distributed to fire management agencies throughout the United States.

The calculator's Custom Read Only Memory (CROM) model embodies fire behavior programs based on Rothermel's model and also calculates National Fire Danger Rating indices. To obtain and record information, the user

The goal of fire behavior scientists is to produce results useful at all levels of fire planning and management, including the person on the fireline.

follows set procedures: selecting the particular program he or she wants, then entering information such as slope class and state of the weather. The CROM can be used in place of the nomograms for manually calculating National Fire Danger Rating indexes and many of the nomograms for estimating fire behavior. When using the TI–59, the entire operation can be performed with a few keystrokes.

Robert Burgan, research forester in the Fire Behavior unit, said, "We attempted to condense years of fire research by many individuals into a convenient field tool." The program is explained in *Fire Danger/Fire Behavior Computations with the Texas Instruments TI–59 Calculator: User's Manual*, General Technical Report INT–61, by Burgan.

Which fuel model?

The mathematical models that provide the basis for predicting fire behavior require detailed descriptions of the fuel properties, or "fuel models," as data. To minimize the burden of data entry and chances of error, a collection of typical data sets was generated and organized as descriptions that represent commonly-encountered fuel situations.

Which fuel model should be used? A report issued by the Intermountain Station can help fire behavior officers, fuel management specialists, and other personnel answer the question. Hal Anderson, physicist in the Fire Behavior unit, is author of *Aids to Determining Fuel Models for Estimating Fire Behavior*, General Technical Report INT–122. He presents color photographs, tabulations, and a similarity chart to use in selecting the appropriate model for a specific field situation. The report includes 13 fire behavior models in 4

groups: grasslands, shrublands, timber, and slash. Each group comprises three or more fuel models; two or more photographs illustrate typical field situations represented by each model. The report is no longer available from the Intermountain Station. It can be ordered from: Superintendent of Documents, Stock No. 001–001–00582–7, at $3.50 per copy.

The personality of a fire

Another tool developed by the Fire Behavior researchers should be especially helpful to the fire behavior officer (FBO), usually part of an overhead team on a fire. Patricia Andrews, mathematician in the work unit, and Rothermel have developed charts for interpreting the characteristics of fire behavior. Using the charts, the FBO can provide specific information on different sectors of a fire. For example, he or she could determine where the fire would be "hot," and where conditions would likely be good for direct attack to succeed. Information developed from using the charts could also help those planning air operations, or assist personnel responsible for safety.

In *Charts for Interpreting Wildland Fire Behavior Characteristics*, General Technical Report INT–131, Andrews and Rothermal illustrate use of a characteristics chart in conjunction with fire prescriptions, fire behavior forecasts, management plans, and briefings. The report includes several charts suitable for copying.

Teaching the concepts

The Station's Fire Behavior scientists have worked closely with land managers since the early years. When the first FBO course was organized at Marana, Arizona, the researchers were asked to develop a system that could be used on the fireline and taught in 2 weeks.

Rothermel says, "I'm not sure how to describe the early sessions, but students who have taken the course hail each other as graduates or survivors of the class of '76 or '77, etc. The course was very successful; however, some of the early material was so weak that the students should have chased all of us instructors off the base. Instead, their support encouraged us to improve the course."

Course material

That support also encouraged the researchers to prepare a manual that culminates 20 years of studies, *How to Predict the Spread and Intensity of Forest and Range Fires*, General Technical Report INT–143, by Rothermel. The report documents the procedures for estimating the rate of spread, intensity, flame length, and size of fires burning in forests and rangelands. The procedures are complete and can be applied by individuals working in the field. The methods pertain to the fine fuels that carry the fire and produce the flames at the fire front.

The manual is a compilation of material developed for the National Wildfire Coordinating Group's S–590 Fire Behavior Officer Course. New material has been added since the methods were first developed and tried in the field in 1976. Until now, access to these methods was available only through the 2-week S–590 course. Rothermel says the manual cannot replace that training, but can serve as a self-study test for those who cannot attend the course, and as a reference for those who do.

Will it work for me?

Tests have demonstrated that the fire behavior model can predict rate of spread with creditable accuracy and do it in diverse fuels. The question remains: How well will the system work in your fuels and under your conditions?

An Intermountain Station report addresses that question and tells how to improve your predictions. *Field Procedures for Verification and Adjustment of Fire Behavior Predictions*, General Technical Report INT–142, was prepared by Rothermel and George C. Rinehart, fuels management specialist on the Toiyabe National Forest, Nevada. The concept is simple: obtain data necessary to predict fire behavior and the corresponding data on actual fire behavior, then compare the predicted with the actual behavior. The authors acknowledge that this is often difficult to do, especially on wildfires. But the methods they present do not require sampling of fuel quantity or fuel moisture or impose the need for expensive equipment not ordinarily available to operating units.

Can wildland fire behavior really be predicted? Rothermel says that depends on how accurate you expect the answer to be. The minute-by-minute movement of a fire will probably never be predictable—certainly not from weather conditions forecast many hours before the fire. Nevertheless, he says, experience coupled with a systematic method of calculating fire behavior yields surprisingly good results.

BEHAVE

The researchers recently gave fire managers another tool: BEHAVE, a computer system that provides the method while the fire manager provides the experience. Designed to be user-friendly, the system requires no previous knowledge of computer operations. It is designed for use by fire managers who are familiar with fuels, weather, fire situations, and the associated terminology. Persons who have used the TI–59 with a fire behavior CROM say that BEHAVE is much easier to use.

BEHAVE, which consits of three interactive computer programs, integrates the results of many studies into a single system. It helps fire managers estimate fire spread rate and intensity, then interprets that into probable flame length, containment time, and final fire size. It will also estimate maximum probable spotting distance and other details, such as the probable spread direction due to a wind blowing cross-slope. BEHAVE is divided into two subsystems: BURN, for operational fire behavior prediction; and FUEL, for fuel modeling.

According to Rothermel, the site-specific features of BEHAVE make it possible to match burning conditions better than past systems. The size of the area being considered is determined by how well the fuels, topography, and weather are known. It may be as large as a drainage or as small as an experimental plot.

BEHAVE was initially tested by 29 users from various agencies, States, and universities in 1982, part of a series of tests required by the Forest Service Computer Systems Coordinating Council. Pilot testing by operations personnel was conducted during the summer of 1983 by all Forest Service Regions except the Alaskan Region, and by the National Park Service, Bureau of Indian Affairs, Bureau of Land Management, six States, and three universities. These tests evaluated the system's performance in the field and the problems of installing it on other computers. The researchers plan to have BEHAVE operational by the summer of 1984.

The system has been installed on several computers, Fort Collins Computer Center, two minicomputers at the Forest level, one minicomputer in Region 5, and at two universities. For use within the Forest Service, the researchers expect to use FLIPS (Forest Level Information Processing System), a system of interconnected minicomputers. Rothermel and other members of the unit are also working with other Federal agencies and States to make BEHAVE available on their computers.

Today's technology in wildland fire prediction has come a long way from the early studies, when the first experimental fires were burned at the Northern Forest Fire Laboratory. As land managers couple their experience with the technology, the professionalism needed for implementing new concepts in fire management can be realized. This comes at a time when fire management policy brings greater demands for quantitative assessment of forest and range fires. The systems developed in the Fire Behavior research program help meet this demand.

New publications

Cone insect damage and seed production

In 1982, scientists with the Rocky Mountain Station collected maturing pine cones on the Coconino and Kaibab National Forests in Arizona, in an effort to determine the incidence of insect damage in second-year cones from different crown levels within the same tree, and to measure their seed production.

Each cone was dissected and cone length and width, and the number of sound, hollow, and insect-damaged seeds were recorded. The percentage of seeds damaged by each insect species was determined for each one.

Cones collected from low, middle, and upper tree crowns had insignificant differences in insect damage. However, there were significant differences in insect damage among areas and among trees within areas. These findings indicate that other factors (elevation, locations producing annual cone crops or crops every 3 – 5 years) influence the degree of damage among trees and locations. Continuous cone production areas suffer the greatest damage from two insects, *Megastimus* and *Conophthorus*.

Healthy seed production was noticeably less in areas with high incidences of *Conophthorus* and *Megastimus* damage, and viable seed was almost non-existant at one location. Such conditions indicate the need for a preliminary insect survey before an area is designated as a cone collection site.

If you would like more information on this study, write the Rocky Mountain Station and request a copy of the reprint *Insect Damage, Cone Dimensions, and Seed Production in Crown Levels of Ponderosa Pine*, by J.M. Schmid, J.C. Mitchell, K.D. Carlin, and M.R. Wagner.

Recreational activities vs. water quality

The Eisenhower Consortium for Western Environmental Forestry Research's ambitious five-year effort to accumulate data on the complex interactions between man and his environment has culminated in a new publication – *Water Resources in the Southern Rockies and High Plains – Forest Recreational Use and Aquatic Life*, which synthesizes research dealing with the interrelationships of man's recreational activities with the multiple aspects of water quantity and quality in the Rocky Mountain West. It discusses the supply-demand relationships of wildland resource activities that affect water quality and watershed-resource-transport mechanisms and the influence of water quality and of levels of streamflow upon aquatic biota.

Land-use policy makers who must make decisions from a variety of alternatives should benefit from this synthesis. It provides the information about the principles of ecological reactions that policymakers need in order to make more cautious and considered decisions in the formulation of land-use policy.

Copies of this publication are available for $29.95, plus $1.00 postage, from University of New Mexico Press, Journalism Building, Room 220, University of New Mexico, Albuquerque, New Mexico 87131.

Red alder bibliography

A bibliography with abstracts lists 661 references to world literature on red alder (*Alnus rubra* Bong.) through May 1978. Included are publications reporting on taxonomy, biology, and silvics, chemical and physical properties, nitrogen-fixing properties, and reports on industrial uses and economic considerations.

Sources of cited publications are scientific journals, trade publications, special reports, and popular books. Abstracts or annotations are included for many references. Subject matter and author indexes are also included. With the growing interest in alder in forestry and

in agro-forestry worldwide, the bibliography should have considerable value. Write to the Pacific Northwest Station and ask for *Red Alder: A Bibliography with Abstracts*, General Technical Report PNW–161, by Charles F. Heebner and Mary Jane Bergener.

Ants are important predators of western spruce budworm

Ants have been noted in forests primarily for their role in invading the family picnic. Now, however, researchers are taking them seriously as an important predator of the western spruce budworm, a major defoliator of western conifer forests. Research has been conducted at the Pacific Northwest Station as part of the Canada/United States Spruce Budworm Program. In a study in western Montana, the role of both birds and ants as predators of western spruce budworm was studied on seedlings of western larch and Douglas-fir. On larch, birds and ants reduced survival of larval budworm at instars IV–VI. On Douglas-fir, larval survival at one site was reduced by ants but not by birds. At a second site, neither birds nor ants had any effect on larval survival, but ants did have a major effect on survival of pupae.

Researchers conclude that ants are far more important than birds as predators of the western spruce budworm. For details, request *Some Effects of Predaceous Birds and Ants on the Western Spruce Budworm on Conifer Seedlings*, Research Paper PNW–315, by Robert W. Campbell, Clinton E. Carlson, Leon J. Theroux, and Thomas H. Egan.

Locating and studying spotted owls

Scientists or others studying spotted owls in the West may have use for a new publication from the Pacific Northwest Station. It is General Technical Report PNW–162, *Methods and Materials for Locating and Studying Spotted Owls*, by Eric D. Forsman.

Forsman has spent considerable time studying spotted owls. This paper describes techniques he (and other biologists) have found most effective. If you want to study spotted owls, first you have to find them. This often means being willing to work at night. According to Forsman, nocturnal calling surveys are the most effective way to locate spotted owls. Roosts and general nest locations may be located during the day by calling in areas where the birds are suspected to be. Locating specific nest trees is more complicated: (1) bait with a live mouse to induce owls to visit the nest, (2) call in suspected nest areas to stimulate the female to call or fly from the nest, or (3) observe adults during prenesting displays.

Techniques are also given for trapping owls and determining their diet.

The fallen tree: its role in the forest

Forest managers are becoming concerned about the extensive removal of woody material from the forest floor as a result of intensive timber management and increasing wood utilization. They want to know the short and long-term biological consequences of such management activities—in terms of nutrient cycling, wildlife habitat, and site productivity.

A new report from the Pacific Northwest Station provides some insights, although no definitive answers. It describes the world of the fallen tree: recruitment to the forest floor, physical characteristics of various stages of decay, contributions to habitat for plants and animals, and something of the history of woody debris in Northwest forests. Some hints are given to forest managers of things to come—that woody debris plays an important role in ecosystem function, that that role may be important to survival and growth of the forests (as well as the wildlife) and that until more is known about this function, the best policy is to maintain as much of the natural diversity of forests as possible.

This paper is the first contribution of "The Fallen Tree—An Extension of the Live Tree," a cooperative research effort of the Forest Service; Bureau of Land Management; Oregon State University, Department of Forest Science; the USDA Agricultural Research Service; and the Oregon Department of Fish and Wildlife.

Don't miss reading, *The Seen and Unseen World of the Fallen Tree*, General Technical Report PNW–164, Chris Maser and James Trappe, Technical Editors.

A test of elk/timber coordination guidelines

During recent years, land managers have used conceptual models for elk habitat to coordinate elk management and timber management. The generalized model, consisting of a cover/forage function and a road density function, is used at the Forest and Regional level for planning required by the Resources Planning Act.

Despite the wide acceptance and use of the elk/timber guidelines concept, variations in application and calculation methods are common. The many forest biologists and land managers who make decisions based on elk/timber guidelines require validation of the models.

L. Jack Lyon, project leader of the Intermountain Station's Wildlife Habitat Research Work Unit at Missoula, Montana, recently completed a study to determine what standardization in existing models is possible and whether the models do, in fact, predict elk behavior in a variety of environments. Field validation tests of elk/timber coordination guidelines were conducted on 11 study areas in western Montana and northern Idaho during the summers of 1980 and 1981. Forty-six observers evaluated elk

habitat quality based on different combinations of cover/forage function. They also compared road models to actual habitat selections as indicated by elk pellet group distribution.

Findings demonstrate that the road-density model is a very powerful tool for evaluating and manipulating elk habitat. Acceptable road models predict over 50 percent of the variation in habitat use by elk. The best of the cover/forage functions tested improved this prediction on only half the validation areas, and then by less than 10 percent.

The Intermountain Station report, *Field Tests of Elk/Timber Coordination Guidelines*, Research Paper INT–325, by Dr. Lyon, contains details of the study. Copies are available from the Intermountain Station.

Weather and climate of the Selway-Bitterroot

One of the largest and most famous wilderness areas in the United States is the Selway-Bitterroot Wilderness of northern Idaho and western Montana. Its recreation values are matched by its example as a primitive heritage, besides being an outdoor laboratory in its most pristine condition.

An important element of any natural environment is its weather and climate. That element of the Selway-Bitterroot is described in the book, *Weather and Climate of the Selway-Bitterroot Wilderness*, by Arnold I. Finklin, meteorologist at the Intermountain Station's Northern Forest Fire Laboratory, Missoula, Montana.

Copies of the 144-page book, at $11.95 each, are available from: University Press of Idaho, Dept. C, P.O. Box 3368, University Station, Moscow, Idaho 83843. Request #LC–83–50098.

A pictorial record of wildlife habitat

Matched photographs are the basis for a record of vegetative succession and wildlife habitat conditions in Montana and Idaho in *Fire and Vegetative Trends in the Northern Rockies: Interpretations from 1871–1982 Photographs*, General Technical Report INT–158.

The report contains 172 photos that provide an unusual opportunity to interpret vegetative changes. The role of fire is treated in some detail because of its importance as a manipulator of vegetation.

Taken in areas representative of major vegetative types, the scenes cover four designated "regions" of Montana and Idaho. The report was written by George E. Gruell, research wildlife biologist with the Intermountain Station's Fire Effects and Use research work unit, Northern Forest Fire Laboratory, Missoula, Montana.

The baseline established by the early photographs can be used to determine how current wildlife habitats compare with those of the past. These visual materials can help land managers select management alternatives that will allow maintenance of productive wildlife habitats.

The Intermountain Station has copies of the report.

A method to inventory understory vegetation

Forest Survey units of the Forest Service have expanded traditionally timber-oriented inventories to include data on understory vegetation. Such information, in combination with overstory data, can be used to evaluate wildlife habitat, grazing potential, and productivity in terms of biomass.

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- ☐ *Understory Vegetation Inventory: an Efficient Procedure*, Research Paper INT-323-FR37.
- ☐ *Field Tests of Elk/Timber Coordination Guidelines*, Research Paper INT-325-FR37.
- ☐ *Construction Cost and Erosion Control Effectiveness of Filter Windrows on Fill Slopes*, Research Note INT-335-FR37.
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Adapting several established methods, researchers at the Intermountain Station have developed a procedure to inventory understory vegetation in the Rocky Mountains. The method, used in Idaho, Colorado, South Dakota, and Wyoming from 1981 to 1983, provided accurate information about plants at each field location sampled by survey crews. Composed of two parts, the system uses a 1/20-acre circular plot surrounding each of the five cluster points used for the timber inventory.

Part I provides individual species information. For each of the four plant groups—trees, shrubs, forbs, and graminoids—up to four species with a crown canopy cover of at least 5 percent are recorded. This provides an indication of the major species composition and horizontal diversity of a plot. Confining the list to predominant plants makes the procedure fast and easy and provides a picture of the basic composition of the vegetation. Part II provides plant information that, when combined with the overstory data, will provide a vegetational profile of the plot.

Understory Vegetation Inventory: an Efficient Procedure, Research Paper INT–323, includes an example of the field data form for a specific plot. Authors are Renee O'Brien, range conservationist, and Dwane D. Van Hooser, project leader, of the Forest Survey Research Work Unit at the Intermountain Station.

Copies are available from the Intermountain Station.

Using logging slash to protect streams

Surface erosion from roads, especially fill slopes, is greatest during the first year following construction. A 6-year study of sediment production from a logging road in the Idaho Batholith revealed that 83.8 percent of the surface erosion occurred during the first year following construction. A similar study in the Horse Creek drainage of north-central Idaho showed that 56 percent of the erosion over a 2-year period occurred in the first 2 and 1/2 months after road construction. Such high runoff presents a challenge to land managers concerned with protecting streams, spawning areas, and the forest ecosystem.

Intermountain Station researchers and cooperators have developed an effective, relatively inexpensive technique to prevent excessive sediment from washing into streams after road construction. The method consists of constructing sediment barriers, called filter windrows, on fill slopes adjacent to streams. The windrows are constructed with logging slash, long known as a deterrent to sediment movement and readily available from a right-of-way clearing operation. Another advantage is that the windrows can be constructed simultaneously with the roads, providing immediate protection of the water resources.

The technique was developed during a study conducted on the Nezperce National Forest, Idaho, by Michael J. Cook, forest engineer, and John King, hydrologist at the Intermountain Station's Forestry Sciences Laboratory in Moscow, Idaho. Field work consisted of staking areas, determining the proximity of suitable slash, selecting stockpile sites, and construction of the windrows. Generally, the entire length of fill slope that could contribute directly to streams was designated for windrow construction. The cost of the treatment was $59 per 100 feet of windrowed slope.

Cook and King say a conservative estimate of the sediment trapping efficiency of the windrows is 75 to 85 percent, based on measurements of erosion on windrowed versus non-windrowed slopes.

Instructions for the technique are included in *Construction Cost and Erosion Control Effectiveness of Filter Windrows on Fill Slopes*, Research Note INT–335.

The Intermountain Station has copies.

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